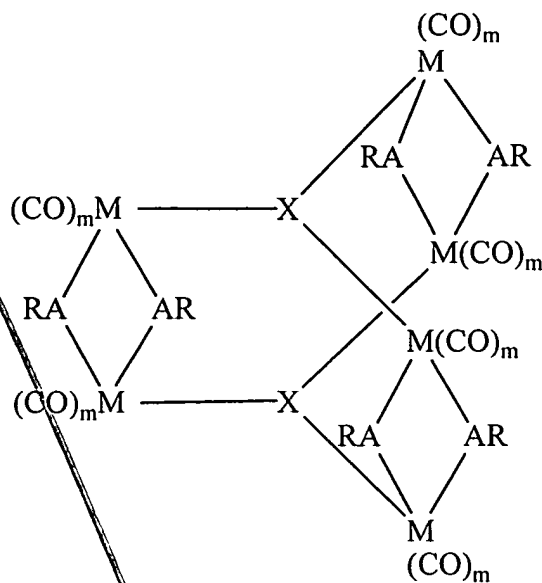


WHAT IS CLAIMED IS:

1. A prismatic supramolecule having the following structure:



wherein

M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os,

X is a nitrogen-based tridentate ligand;

A is O, S, Se, or Te;

R is $C_1\sim C_{16}$ alkyl, $(CH_2)_n$ -aryl, or $(CH_2)_n$ -aryl-(O- $C_1\sim C_{16}$ alkyl) $_p$, in which n is 0-15, p is 1-3; and

m is 1, 2, 3, 4, or 5.

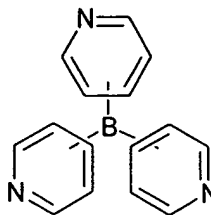
2. The prismatic supramolecule of claim 1, wherein M is Re.

3. The prismatic supramolecule of claim 2, wherein m is 3.

4. The prismatic supramolecule of claim 1, wherein R is $C_1\sim C_{16}$ straight chain alkyl.

5. The prismatic supramolecule of claim 1, wherein A is O.

6. The prismatic supramolecule of claim 1, wherein X is triazine or a ligand of the formula:



wherein B is alkyl, alkenyl, alkynyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

7. The prismatic supramolecule of claim 6, wherein X is 1,3,5-triazine.

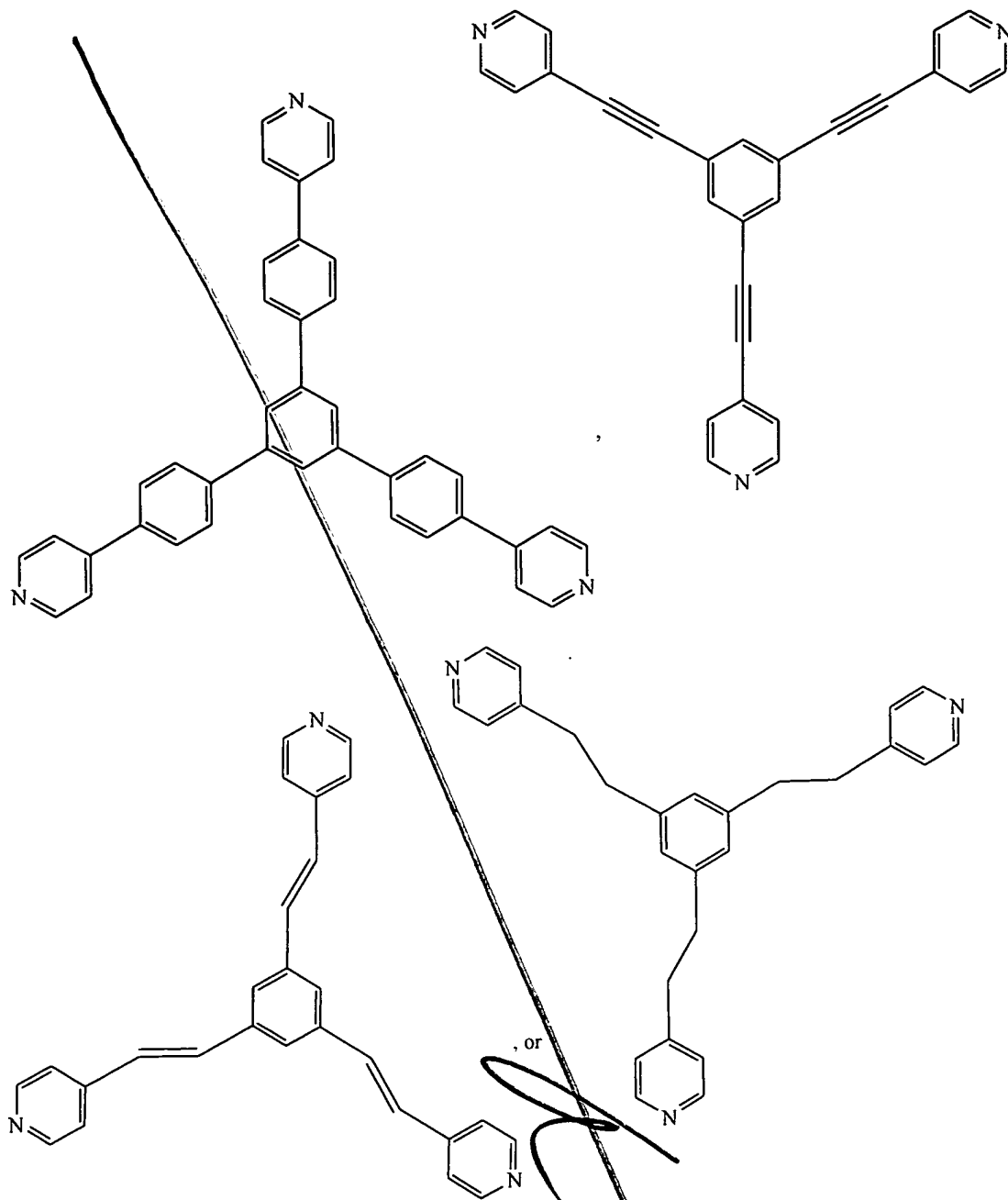
8. The prismatic supramolecule of claim 7, wherein X is 2,4,6-tri-4-pyridyl-1,3,5-triazine.

9. The prismatic supramolecule of claim 6, wherein M is Re and m is 3.

10. The prismatic supramolecule of claim 6, wherein R is C₁~C₁₆ straight chain alkyl.

11. The prismatic supramolecule of claim 6, wherein A is O.

12. The prismatic supramolecule of claim 6, wherein X is

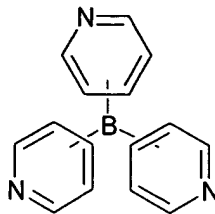


13. A method for making a prismatic supramolecule of claim 1, the method comprising reacting $M(CO)_{m+2}$ with a nitrogen-based tridentate ligand in the presence of an RAH at an elevated temperature to form the prismatic supramolecule, wherein M, m, R, and A are as defined in claim 1.

14. The method of claim 13, wherein M is Re and m is 3.

15. The method of claim 13, wherein RAH is a $C_1 \sim C_{16}$ aliphatic alcohol.

16. The method of claim 13, wherein X is triazine or a ligand of the formula:



5 wherein B is alkyl, alkenyl, alkenyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

17. The method of claim 16, wherein X is 1,3,5-triazine.

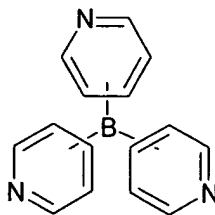
18. A composition for emitting luminescence at room temperature, comprising:
10 a prismatic supramolecule of claim 1 and an aqueous solution.

19. The composition of claim 18, wherein M is Re and m is 3.

20. The composition of claim 18, wherein R is a $C_1 \sim C_{16}$ aliphatic alkyl.

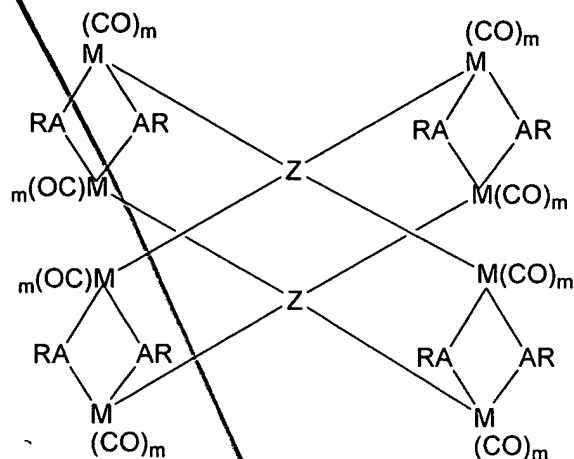
21. The composition of claim 18, wherein A is O.

22. The composition of claim 18, wherein X is triazine or a ligand of the formula:



20 wherein B is alkyl, alkenyl, alkenyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

23. A tetragonal prismatic supramolecule having the following structure:



wherein

M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os,

Z is a nitrogen-based tetradentate ligand;

A is O, S, Se, or Te;

R is $C_1\sim C_{16}$ alkyl, $(CH_2)_n$ -aryl, or $(CH_2)_n$ -aryl-(O- $C_1\sim C_{16}$ alkyl) $_p$, in which n is 0-15, p is 1-3; and

m is 1, 2, 3, 4, or 5.

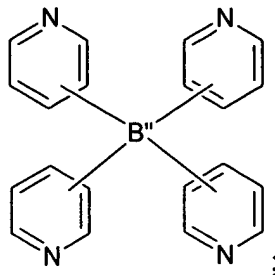
24. The tetragonal prismatic supramolecule of claim 23, wherein M is Re.

25. The tetragonal prismatic supramolecule of claim 24, wherein m is 3.

26. The tetragonal prismatic supramolecule of claim 23, wherein R is $C_1\sim C_{16}$ straight chain alkyl.

27. The tetragonal prismatic supramolecule of claim 23, wherein A is O.

28. The tetragonal prismatic supramolecule of claim 23, wherein Z is tetrazine or a ligand of the formula:



wherein B'' is alkyl, alkenyl, alkenyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

29. The tetragonal prismatic supramolecule of claim 28, wherein B'' is alkenyl,
5 alkenyl, or aryl.

30. The tetragonal prismatic supramolecule of claim 29, wherein Z is 1,2,4,5-
tetraethynyl(4-pyridyl)benzene.

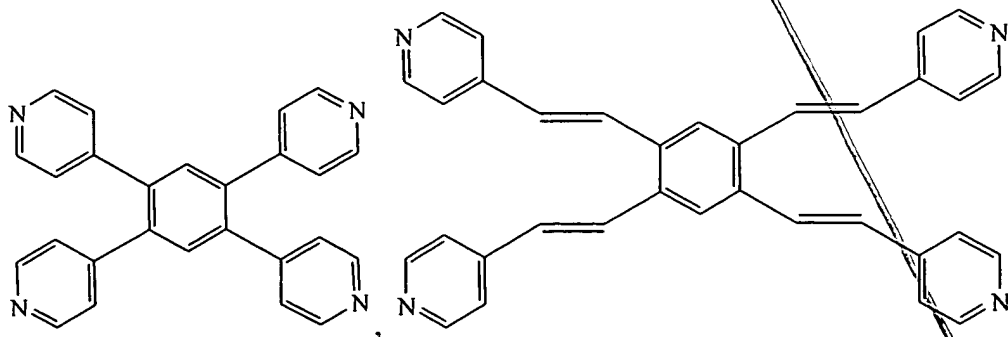
31. The tetragonal prismatic supramolecule of claim 28, wherein M is Re.

32. The tetragonal prismatic supramolecule of claim 28, wherein m is 3.

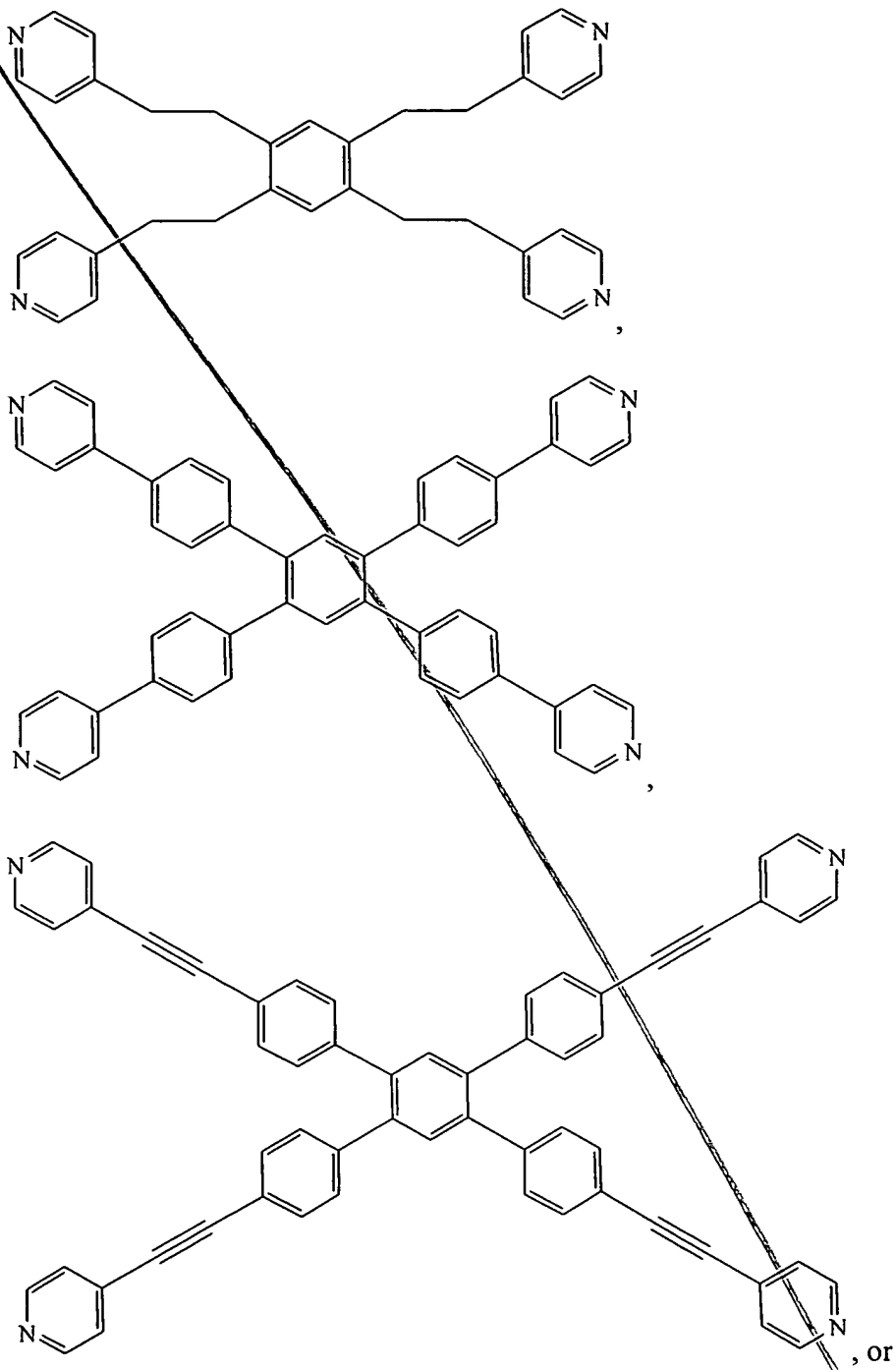
33. The tetragonal prismatic supramolecule of claim 28, wherein R is C₁~C₁₆
15 straight chain alkyl.

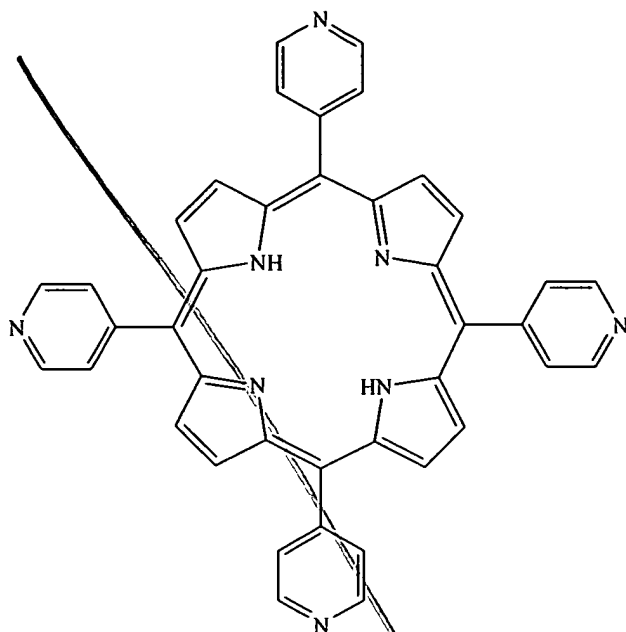
34. The tetragonal prismatic supramolecule of claim 28, wherein A is O.

35. The tetragonal prismatic supramolecule of claim 28, wherein Z is



a'
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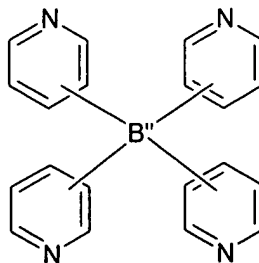


36. A method for making a tetragonal prismatic supramolecule of claim 23, the method comprising reacting $M(CO)_{m+2}$ with a nitrogen-based tetradentate ligand in the presence of an RAH at an elevated temperature to form the prismatic supramolecule, wherein M, m, R, and A are as defined in claim 23.

37. The method of claim 36, wherein M is Re and m is 3.

38. The method of claim 36, wherein RAH is a $C_1 \sim C_{16}$ aliphatic alcohol.

39. The method of claim 36, wherein Z is tetrazine or a ligand of the formula:

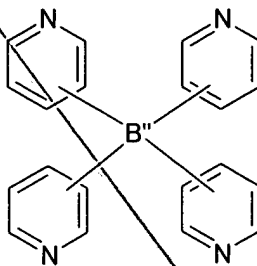


wherein B'' is alkyl, alkenyl, alkenyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

40. A composition for emitting luminescence at room temperature, comprising:

a tetragonal prismatic supramolecule of claim 23 and a solution.

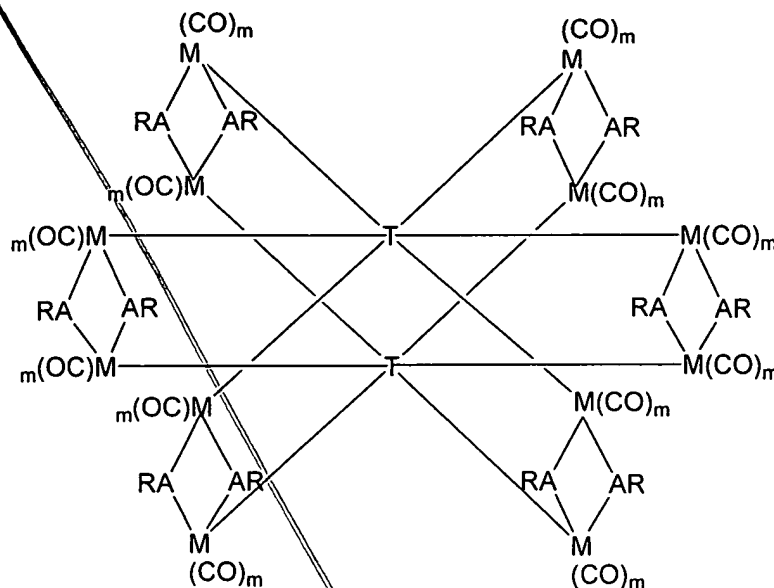
41. The composition of claim 40, wherein M is Re and m is 3.
42. The composition of claim 40, wherein R is a $C_1 \sim C_{16}$ aliphatic alkyl.
43. The composition of claim 40, wherein A is O.
44. The composition of claim 40, wherein Z is tetrazine or a ligand of the
formula:



wherein B'' is alkyl, alkenyl, alkynyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

45. The composition of claim 40, wherein the solution is an aqueous solution.

46. A hexagonal prismatic supramolecule having the following structure:



wherein

M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os,

T is a nitrogen-based hexadentate ligand,

A is O, S, Se, or Te;

R is $C_1\sim C_{16}$ alkyl, $(CH_2)_n$ -aryl, or $(CH_2)_n$ -aryl-(O- $C_1\sim C_{16}$ alkyl)_p, in which n is 0-15, p is 1-3; and

m is 1, 2, 3, 4, or 5.

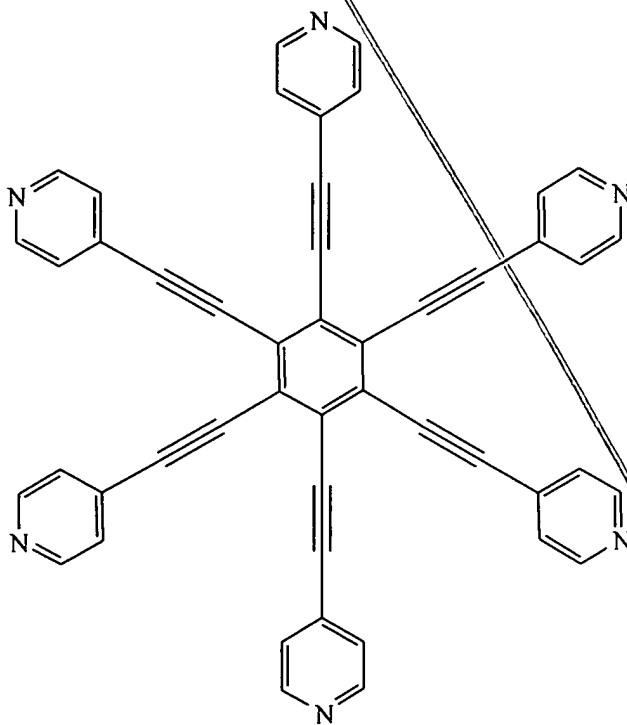
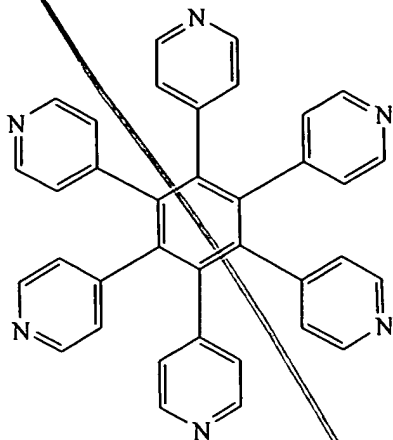
47. The hexagonal prismatic supramolecule of claim 46, wherein M is Re.

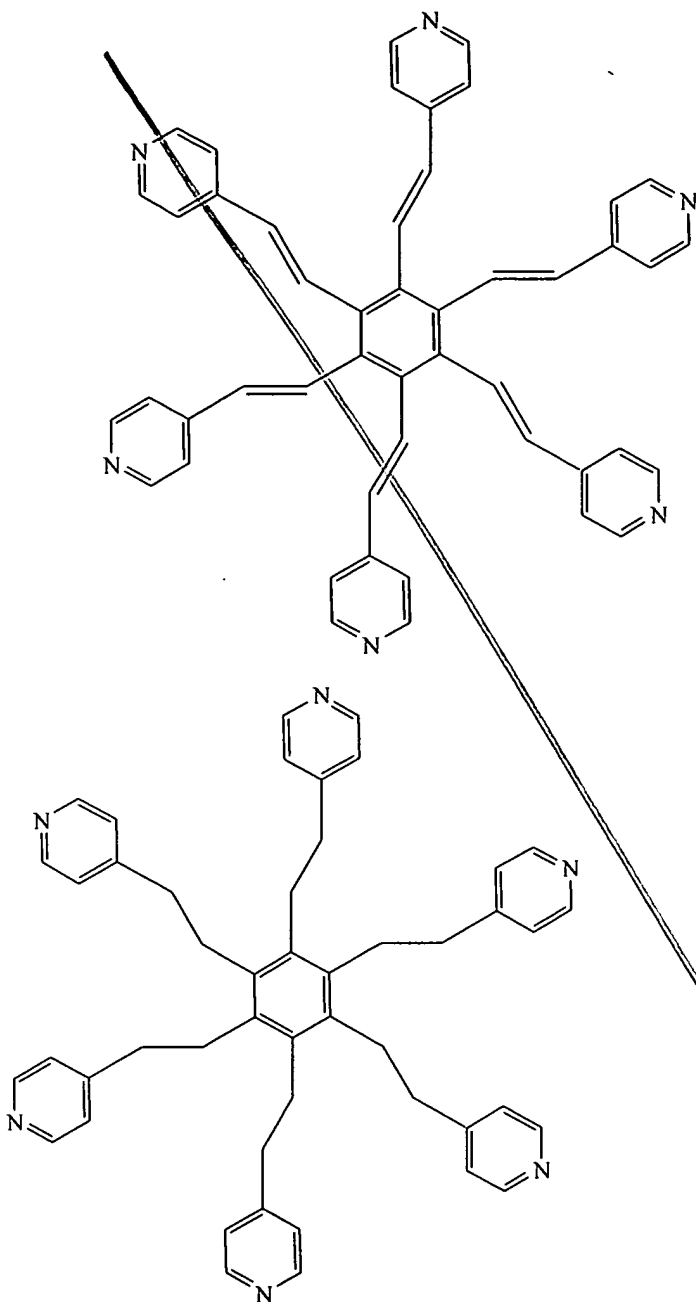
48. The hexagonal prismatic supramolecule of claim 47, wherein m is 3.

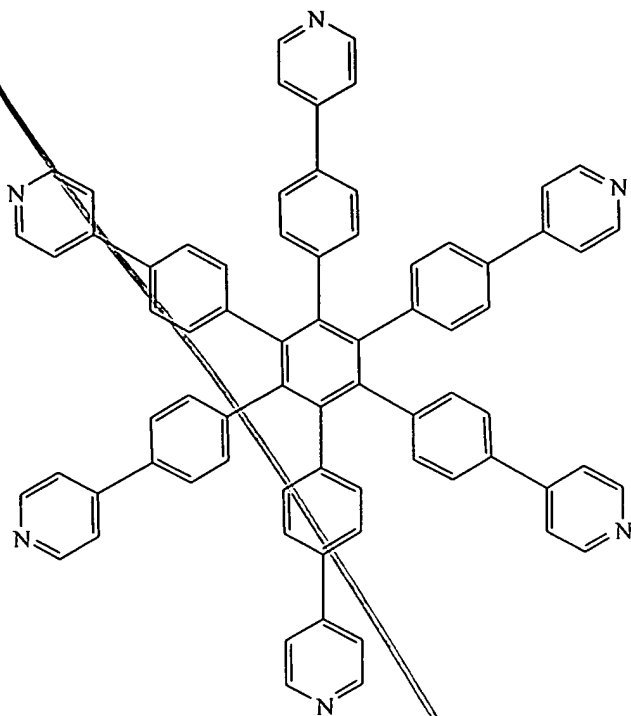
49. The hexagonal prismatic supramolecule of claim 46, wherein R is $C_1\sim C_{16}$ straight chain alkyl.

50. The hexagonal prismatic supramolecule of claim 46, wherein A is O.

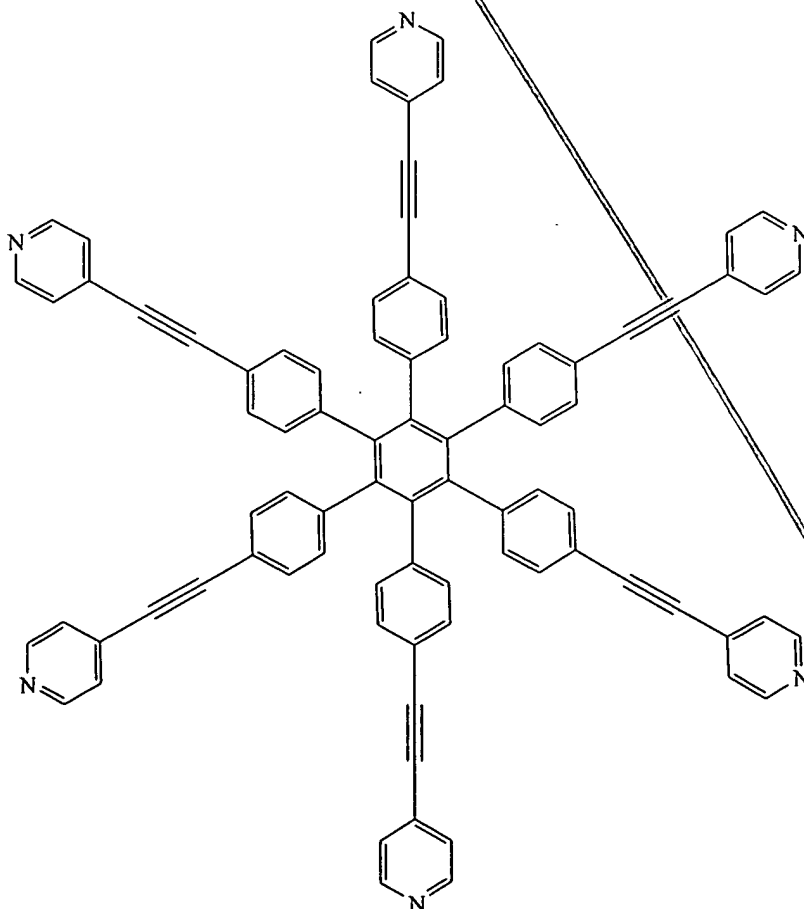
51. The hexagonal prismatic supramolecule of claim 46, wherein T is



a'
cont



, or



52. A method for making a hexagonal prismatic supramolecule of claim 46, the method comprising reacting $M(\text{CO})_{m+2}$ with a nitrogen-based hexadentate ligand in the presence of an RAH at an elevated temperature to form the hexagonal prismatic supramolecule, wherein M, m, R, and A are as defined in claim 46.

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53. The method of claim 52, wherein M is Re and m is 3.

54. The method of claim 52, wherein RAH is a $\text{C}_1\sim\text{C}_{16}$ aliphatic alcohol.